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Traffic Management: The Respective
Roles of Competition Law and
Regulation

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“The most effective way to ensure that traffic prioritisation does not distort competition is to ensure that broadband markets remain or become competitive”²

I. SOME TECHNICAL BACKGROUND

The internet is the most important network of global independent computer networks. The key performance criteria or quality of service (“QoS”) for computer networks are given by delay or latency, measured in milliseconds and indicating how long it takes for a data package to travel from the source to the destination and back;³ jitter, the variance in delay over time; maximum bandwidth as determined by the technology and measured in Bit/s; and effective bandwidth, indicating the actual transfer rate. An important distinction is between packet switching and circuit switching. In circuit switching a physical connection is maintained, for example, in the case of analogue telephone connections. Packet switching, in contrast, divides the information to be sent, e.g. a phone conversation, into individual network packets called datagrams that are sent independently and reassembled based on their packet number at destination. Packet switching substantially reduces latency and increases system stability.

Internet service providers (“ISPs”) offer internet services mainly through digital subscriber lines (“DSLs”) to content and application providers (“CAPs”) such as Facebook, eBay, or Google and to end users. Small CAPs operate based on a flat rate whereas more substantial CAPs exhibit more complex contract structures. ISPs can be divided into three categories: Tier-1 ISPs operate large global backbones, tier-2 ISP’s operate on a regional or national basis, and tier-3 ISPs provide only local internet services. The contractual arrangements between ISPs differ and can be categorized as either peering (involving no payments or transfers) or transit (agreements including payments). Transit describes the exchange of data from one ISP to another

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² OECD, *Internet Traffic Prioritisation: An Overview*, p. 30 (2007), to be found at: <http://www.oecd.org/dataoecd/43/63/38405781.pdf>.

³ This is called roundtrip latency that can be measured with programs such as ping.

transmitting through the network of a third ISP. Peering, in contrast, is a bilateral exchange. Transit agreements typically involve payments whereas peering, at least among equally sized ISPs, is typically based on bill and keep (“BAK”), not involving any payments. Some of the large CAPs such as Google and Facebook are vertically integrated into so-called autonomous systems that function (or could function) as ISPs.

The main economic effect of the internet is the reduction of information cost or transaction cost more generally. This has had a profound impact on many service and product markets, reducing the importance of geographic distances. Companies such as Facebook, Google, eBay, and Amazon testify to this.

The traditional method for data transfers on the internet is based on a best effort service approach. This implies that no transfer quality is guaranteed as every package is treated individually and no general prioritization of packages or types of packages exists. This is in stark contrast to traditional phone lines that are characterized by minimum quality standards that derive from the necessity that the line cannot be dropped. For many applications best effort service is unproblematic as delay and latency are not crucial; however, certain services require a higher quality connection.

II. ORIGIN AND SCOPE OF THE DEBATE

One of the reasons for the controversial debate concerning traffic management is the normative implication associated with terms such as neutrality, prioritization, and discrimination.⁴ While there are no universally accepted definitions, the broad term “network neutrality,” is generally used to refer to the equal treatment in terms of price and quality of internet traffic by ISPs over wired or wireless networks, and the right of users to access content and services on the internet on a non-discriminatory basis. Generally it is possible to distinguish between network neutrality as: (a) a prohibition of price differentiation, i.e. the transfer prices should not vary based on data content or receiver or sender identity, and (b) prohibition of quality differentiation, i.e. the prioritization, delay, or blocking of data based on its content or receiver or sender identity.

The term “network neutrality” is closely related to the concept of a “common carrier,” dating from 16th century English common law first developed around port authorities, but going back further to Roman law concepts. A common (or public) carrier, in its original meaning, is a private entity that, under the authority of a regulatory body, provides a service to the general public without discrimination. The typical examples of common carriers are in the shipping and freight traffic businesses.

The preconditions for the debate on internet traffic prioritization or network neutrality were given by a set of innovations that occurred in the 1990’s that allowed the classification of data packets. Packet inspection procedures allow a real time classification of types of packages and therefore open up the possibility to prioritize, delay, or block certain content and, of course, also to price discriminate between types of packets. This implies that ISPs can, as long as the

⁴ See P. Larouche, *Network Neutrality: The Global Dimension*, SSRN working paper (2012), emphasizing the illusion of unity that the terms create when, in fact, the issues are rather complex and span from technical and economic questions to broader societal issues.

traffic is not encrypted and channeled through a virtual private network (“VPN”), identify what type of service the package belongs to; a method, for instance, employed to block or throttle illegal peer-to-peer (“P2P”) traffic with so-called deep packet inspection tools.⁵ Based on this technology, ISPs have envisioned the possibility of determining price and quality of data transfers based on the content or type of data. In particular, with the increase in the use of internet services manifested by an increase in internet users, users’ behavior, and the technical demands of services such as Voice over IP telephony (“VoIP”), Video on demand (“VoD”), online-gaming, and others, this is considered a way to effectively address network congestion at any given capacity.

The network neutrality debate began when some ISPs in the United States started to impose restrictions on their internet access service; for example, when Comcast hampered P2P and Madison River blocked access to VoIP traffic that competed with their own voice service offerings.⁶

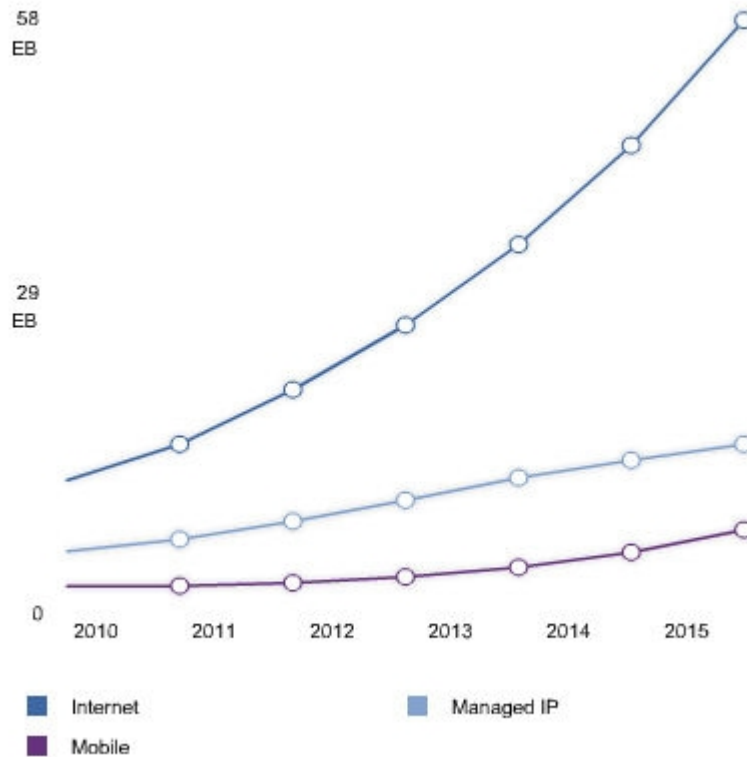
The regulatory context for wired broadband internet differs substantially between countries in Europe, on the one hand, and Asia and North America on the other hand. Unbundling policies allowing access to the local loops of incumbent network operators for competitors are the main reason for the greater consumer choice in fixed network access in Europe. This is in line with a study that finds that 96 percent of consumers in the United States had, at best, only the choice between two retail fixed network broadband ISPs in 2008.⁷ The context for wireless broadband internet differs less and continues to be shaped in part by mergers.

Nevertheless, the internet traffic management debate has also become an important regulatory discussion in the European Union. Some ISPs, largely incumbent telecommunication and cable television providers, would like to charge internet content providers for access to their own internet customers in order to increase next generation fixed and wireless network investments. They note increasing demand for these services and feel they should be permitted to differentiate the level of internet traffic exchanged with these networks. This is sometimes referred to colloquially as providing “fast lanes” (i.e. traffic prioritization) to particular CAPs.

⁵ This is, for instance, applied in France by ISPs under the so-called Hadopi legislation named after the Haute Autorité pour la diffusion des oeuvres et la protection des droits sur l’Internet. See Loi, 2009-669 du 13 juin 2009 favorisant la diffusion et la protection de la création sur internet, JORF no. 135, p. 9666 and its amendment, Loi, 2009-1311 du 28 octobre 2009, JORF no. 251, p. 18290.

⁶ In some sense the network neutrality debate is much older and has played out in many forms on telecommunication networks including questions such as whether the telecommunications operator would allow a fax machine to be connected to a phone line or would require it to be operated from a separate dedicated fax line.

⁷ S. Wallsten & C. Mallahan, *Residential Broadband Competition in the United States*, SSRN working paper (2010).

Figure 1. Global IP traffic, Exabyte(EB)⁸/month 2010-2015

*Cisco VNI June 2011

Based on packet inspection technology, ISPs can take a variety of actions that improve or reduce the quality of the connection between consumers and content or application providers, with potentially substantial implications for network use such as for e-commerce. Traditionally, the exchange of internet traffic has been independent of the content of packets or the identity of the end network senders or receivers. It is true that some networks, in countries such as Australia and New Zealand, have provided different levels and pricing for their own customers to their own “on net traffic” (for content such as games, music, or video). Concerns with traffic prioritization, however, arise where differential treatment is proposed for traffic exchange with third-party networks (i.e. advantaging one third-party provider over another) and when there is insufficient choice for consumers, thereby allowing ISPs to block or degrade third party service in a manner that favors an ISP’s own content or service.

⁸ An exabyte (EB) of monthly traffic would approximately allow transferring the data stored on over a million 1 terabyte (TB) hard drives. A bit, a combination of the word binary and digit, is a single numeric value (either 1 or 0) encoding a single unit of digital information. A byte is a sequence of eight bits. An exabyte (EB) equals 1024 petabyte (PB), a petabyte equals 1024 terabyte (TB), a terabyte equals 1024 gigabyte (GB), a gigabyte equals 1024 megabyte (MB), a megabyte equals 1024 kilobyte (kB) and a kilobyte equals 1024 byte.

An ISP's ability to:

- discriminate based on the identity of the sender/receiver by blocking internet content, impose different charges or differential treatment on internet companies for carrying the vertically integrated ISPs' content, or impose certain types of pricing models (tiered charges) for retail internet broadband services sold to consumers;
- perform network management such as traffic prioritization or traffic shaping; or
- block certain internet content or applications from being accessed or used by consumers

may or may not provide greater incentives for investment in infrastructure and a more efficient use of existing capacity during peak load.

Even when such differentiation does not foster new infrastructure investments and only addresses peak load capacity problems, it raises a number of potential issues for policy makers ranging from whether there is sufficient competition to apply market discipline to these practices to straight-forward competition law violations. Other examples of content discrimination or blocking include ISPs or device manufacturers controlling the content or applications that can be accessed by end-users on their internet platforms or devices.⁹

Charging different prices for differences in service quality is common in delivery industries such as postal services, and it is a practice that, according to some, may be fully compatible with network neutrality. ISPs already offer varying tiers of services (typically based on theoretical download speeds or total capacity) to consumers. On the other hand, other aspects associated with network neutrality, and linked not only to content and identity but also the blocking of certain content or applications, have no obvious parallels and may raise serious competition concerns. Some jurisdictions are seeking to address these issues via regulation or by setting down principles that act as guidelines for acceptable practices. The Netherlands and Chile, for example, have passed legislation in respect to network neutrality.

The internet traffic prioritization, traffic management, or network neutrality debate (however it is labeled) fundamentally centers on the question of how packet inspection technology can be used and, more specifically, if data packet inspection should be used to differentiate price and or quality.

As most ISPs operate based on flat-rate contracts, end users typically face no incentive to constrain their use of the internet as their marginal cost for generating traffic is zero. As soon as congestion on the network occurs, however, the marginal cost of additional traffic becomes strictly positive. The economic efficiency of flat-rate tariffs is therefore dependent on total

⁹ A recent example is discussed in the *New York Times* of June 22, 2011. According to the *New York Times*, KPN, the Dutch Telekom incumbent, observed that 85 percent of the company's customers who use a Google Android phone downloaded WhatsApp onto their handsets from August 2010 through April 2011. As a result, KPN's revenue from text messaging, which had risen 8 percent in the first quarter of 2010 from a year earlier, declined 13 percent in the first quarter of 2011. It is in the context of an envisioned new set of mobile data tariffs that, according to the *New York Times*, the Netherlands "became the first country in Europe...to enshrine the concept of network neutrality into national law by banning its mobile telephone operators from blocking or charging consumers extra for using Internet-based communications services like Skype or WhatsApp, a free text service."

marginal cost being zero, something that is only the case for traffic below maximum capacity, i.e. in the absence of congestion. When congestion occurs, the effects are asymmetric as some services will not be or only marginally be affected by congestion, whereas other services such as online gaming, for example, may be substantially degraded or may not work at all.

Similar to electricity grids where, in theory, electricity prices could be adjusted depending on capacity utilization with an aim to spreading energy consumption in an efficient fashion over the day—mimicking generation patterns—data transfer could be based on life pricing. As this is difficult to implement in a transparent way for end users, traffic management may be a more efficient way to realize the same effects. It also appears superior to daily price schedules based on historic values.

III. CONGESTION, EXPANSION, AND EXCLUSION

The discussion on internet traffic management can be divided in two problem clusters, namely the problem of peak demand in wired and wireless networks—similar to the classic congestion problems in road traffic management—and the problem of strategically blocking or degrading access to content and services in an exclusionary effort. In addition, there is the problem of capacity expansion.

With incremental costs of bandwidth being essentially zero until full capacity or peak capacity is reached, there are basically two choices for a supplier when a bandwidth has reached full capacity. First, the peak capacity of the network can be expanded by increasing total network capacity, typically via new investments (roll out of fiber optic lines, 4G, etc.). Second, capacity can be rationed, again in one of two ways. Rationing of capacity can be established through some form of traffic management during times of network congestion, or capacity can be rationed through various pricing structures, for example on the basis of a data or bandwidth cap, irrespective of whether there is congestion in the network or not.¹⁰

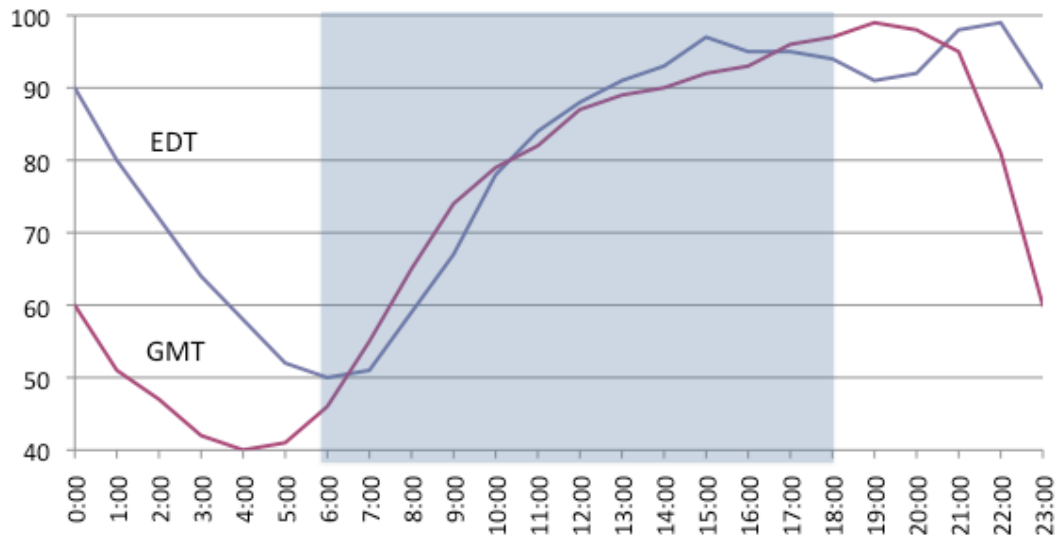
The debate on internet traffic prioritization therefore boils down to enabling efficient traffic management solutions and ensuring the efficient expansion of bandwidth on wired and wireless networks, in the overall interest of users. While efficient traffic management will address the problem of congestion at a given capacity, it will not automatically generate the appropriate incentives to increase capacity. In addition, traffic shaping may also not always be directed at alleviating congestion on the network, but ISPs may rather target traffic that customers value most or that has the biggest negative impact on the business model of the operator. Besides potentially allowing efficient congestion management, traffic management rules, therefore, may also or possibly even primarily be used as anticompetitive and exclusionary tools. This latter risk, together with the redistributive consequences for ISPs and CAPs, is the reason that the network neutrality debate has created much regulatory attention.

In light of the current and projected rapid increases in demand for bandwidth on wired and, to an even larger extent, on wireless networks, the potential traffic congestion problems may

¹⁰ The latter approach of instituting data caps seems to be of decreasing significance. Either way, data caps are an inefficient way of addressing congestion as there is no reason to ration outside of congestion hours when plenty of bandwidth is available. It seems that data caps are rather used for product differentiation purposes than for dealing with congestion.

require traffic management measures in the form of price or quality discrimination. In addition, however, it should not be forgotten that the real question rather concerns the issue of how increased efforts in expanding capacity can be brought about.

Figure 2. Daily Traffic Europe and North America¹¹



Traffic management is often viewed as an alternative to additional capacity investments—at least at the margin. Without traffic management, congestion or over-investment in network capacity will occur. To the extent that appropriate traffic management allows identical benefits to consumers in terms of network capacity, while being cheaper than new investments, it is more efficient to alleviate the congestion problem via traffic management tools rather than engaging in additional network expansions. From the perspective of projected internet usage growth rates, however, traffic management alone is unlikely to solve the problem if it does not generate the appropriate incentives for additional investments.

Traffic management can therefore not be considered the ultimate answer. In fact it is already clear that, by itself, it will not generate all the necessary capacity. Indeed, it is arguable that traffic management is confined to optimizing network use at the tipping point between a well-functioning network and a congested one. There may also be a strong argument for limiting traffic management as a solution in that some forms of traffic management may also have severe implications for the development of new applications or the types of applications that can be used, possibly hindering innovation.

IV. THE ROLE OF COMPETITIVE MARKETS

According to some, traffic management measures require regulatory oversight to avoid abusive behavior. At least the *ex post* monitoring of regulators and/or competition authorities in order to avoid abuse in the presence of market power are typically considered necessary. In light

¹¹ See <http://Ispreview.co.uk>. 100 is indexed and not necessarily equivalent to full capacity.

of the perceived need for traffic management, and the fact that blocking, traffic deterioration, throttling, and so forth are activities not necessarily to the detriment of consumers (as noted recently for example by the Italian regulator)¹² it is a pertinent question whether *ex ante* regulatory measures are needed or if *ex post* measures, for example those imposed by a competition authority, are sufficient.

There is widespread agreement that traffic management tools should be transparent and switching should be easily possible.¹³ Presupposing, in addition, effective retail competition (supported by appropriate access regulation)—a possibly unrealistic assumption in many broadband markets—it is not clear whether

- network providers should be forced to treat all sources of internet content equally, and
- whether the right of a consumer to access content and services on the internet should be based on strict non-discrimination rules that may have the potential effect of hampering effective congestion management.

Generally, *ex post* supervision by regulators and competition authorities may be preferable to *ex ante* regulatory intervention in those cases where (wired and wireless) broadband markets are competitive. This is due to the fact that concerns about discrimination are most pertinent when network operators have substantial market power. In such circumstances exclusionary conduct may often be profitable and detached from (benign) traffic management efforts that can be traced back to congestion problems.¹⁴ Under these conditions, network operators would no longer discriminate, for example, between premium and basic services to manage peak traffic loads, but use these measures to exploit market power in anticompetitive ways, which would stifle competition and innovation and ultimately prove to be detrimental to consumers.

Using standing competition principles, consumer harm from exclusionary conduct by ISPs or CAPs is dependent on two cumulative criteria being met¹⁵:

- The ISP (or the ISP arm of a vertically integrated CAP) should have market power.
- The ISP or CAP should be vertically integrated (offering both, internet services and content and applications), or envision becoming vertically integrated in the near future, or have partnership agreements or other vertical links effectively bringing it close to a vertically integrated ISP/CAP.

¹² AGCOM 2011 Neutralita' della rete: avvio di consultazione pubblica, Allegator B. The recent Chilean and Dutch legislation on network neutrality, however, take a different view and were, in fact, not about traffic prioritization but rather about market segmentation and the protection of existing business models.

¹³ See the 2007 OECD Report on Internet Traffic Prioritisation: An Overview, to be found at: <http://www.oecd.org/dataoecd/43/63/38405781.pdf>. It is, however, far from clear to what extent and where this is currently a reality. Switching costs are often important and even more so if services are bundled.

¹⁴ For a general discussion of exclusionary conduct in the form of refusal to deal, see the 2007 OECD Roundtable Compilation on Refusal to Deal to be found at <http://www.oecd.org/dataoecd/44/35/43644518.pdf>.

¹⁵ Of course abuse may also occur without integration or the intent of integration as an ISP might charge excessive prices or a CAP could seek exclusivity with an ISP, thereby excluding rivals. Both possibilities exist; however, they are not the ones considered particularly likely. See the 2012 OECD Roundtable Compilation on Excessive Prices to be found at <http://www.oecd.org/dataoecd/5/3/49604207.pdf>.

Given these criteria, one *ex ante* regulatory approach to avoiding exclusionary problems right from the beginning is appropriate access regulation (local loop unbundling or bitstream) that ensures that no individual ISP has market power on the retail level.¹⁶

In addition, there is also an important role to be played by competition policy in the form of effective merger control. As previously noted, market concentration is much more of a problem in the US¹⁷ than in the EU.

Nevertheless, recent decisions, for example the European Commission's clearance of Orange and T-Mobile¹⁸ in the United Kingdom is unlikely to have positive effects on competition in wireless broadband markets.¹⁹ Of course, the question of market power crucially hinges on the question of market definition. Currently, in the view of many, wireless ISP's are unlikely to be in the same market as wired ISP's—at least for most of the services offered where they are considered to have complimentary capabilities.

V. CONCLUSION

Four central points seem to emerge from the technical economic debate:

¹⁶ This is of course closely related to local loop unbundling and access regulation or the problem of entry barriers more generally. On unbundling and structural separation see the forthcoming OECD Report on Experiences with Structural Separation.

¹⁷ The re-merger of the individual parts of the 1982 split of AT&T, Verizon, Qwest, and AT&T make for only three players with a market share of 80 percent of telecom subscriptions, and the leading five cable TV providers (Comcast, TimeWarner, Cox, Charter, and Cablevision) make for more than 70 percent of cable subscription on the national level. In addition, only four national mobile providers remain, two of which are incumbent operated. See P. Larouche, *Network Neutrality: The Global Dimension*, SSRN working paper (2012). See also S. Wallsten & C. Mallahan, *Residential Broadband Competition in the United States*, SSRN working paper (2010) already cited above. For an empirical analysis of the situation in U.S. telecommunications markets, see S. K. Majumdar, U. Yaylaciçegi & R. Moussawi, *Mergers and synergy: Lessons from contemporary telecommunications history*, (36) TELECOMMUNICATIONS POL'Y 140-154 (2012) suggesting, based on a performance analysis of post-merger firms, that "expected post merger synergies were a mirage" (p.152) and that firm performance actually declined after the merger.

¹⁸ The Orange and T-Mobile merger in the United Kingdom was a so-called 5 to 4 merger although some commentators have claimed that it was closer to a 5 to 3 merger in light of the weak competitive constraint exerted by the third operator. The AT&T and T-Mobile merger in the United States, if it had been approved, would have resulted in the reduction of operators from 4 to 3 or, according to some commentators, even to a duopoly of Verizon and AT&T as Sprint would have only exerted a limited competitive constraint. To the extent that T-Mobile acts as maverick on the U.S. market, the outlook would have been even dimmer. For an overview of the AT&T/T-Mobile case see A. P. Grunes & M. Stucke, *Antitrust Review of the AT&T/T-Mobile Transaction*, Federal Communications Law Journal (2011), 64(1), 47-85.

¹⁹ The same would have applied to the Vodafone/Wind Hellas merger. In light of the Orange/T-Mobile precedent this now abandoned 3 to 2 merger in Greece would not have been easy to block. For a critical discussion of U.S. merger control see L. M. Frankel, *The Flawed Institutional Design of U.S. Merger Review: Stacking the Deck Against Enforcement*, UTAH L. REV 159 (2008) and J. Baker & C. Shapiro, *Detecting and Reversing the Decline in Horizontal Merger Enforcement*, 22(3) ANTITRUST (2008). For a critical discussion of EU merger control, see F. Maier-Rigaud & K. Parplies, *EU Merger Control Five Years After The Introduction Of The SIEC Test: What Explains The Drop In Enforcement Activity?*, 30(11) EUR. COMPETITION L. REV., pp. 565-579 (2009), to be found at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1827662. G. Le Blanc & H. Shelanski, *Telecommunications Mergers in the EU and US: A Comparative Institutional Analysis*, in: Merger Remedies in American and European Union Competition Law, pp. 172-207, H. Shelanski & F. Lévêque eds., Northampton, Mass.: Edward Elgar (2003), provide a discussion of some of the relevant differences between the EU and the US.

- As long as consumers and innovation are protected, ISP's should have the option of using different QoS.
- Strong competition and, in particular, the absence of substantial market power of vertically integrated ISPs/CAPs are vital if markets are to be relied upon to generate desirable results.
- Reductions in switching costs and improved transparency concerning traffic management measures are essential in allowing broadband competition to develop its full potential.
- Supervision by regulators and competition authorities combined with *ex post* interventions are not in contradiction with general sector specific guidelines.

There can be no doubt of the importance of appropriate internet traffic management measures and new investments in next generation technologies for the development of the internet, e-commerce and economic development, and prosperity overall.

To the extent that markets for wired and wireless broadband internet are competitive, for instance due to appropriate competition law enforcement and access regulation, traffic management measures are unlikely to be problematic and are therefore unlikely to require much regulatory oversight. High market concentration and the general finding that mergers often do not lead to efficiencies, a highly pertinent finding seemingly confirmed also in the telecommunications sector, points to the important role of competition policy.

A division of labor between appropriate *ex ante* (mainly access) regulation that generates and fosters functioning broadband competition—possibly also regulating traffic-prioritization methods not aimed at addressing congestion issues in less competitive markets—and effective *ex ante* merger enforcement combined with *ex post* competition law enforcement focusing on abuses of market power may be the right mix capable of addressing potential consumer harm in broadband wireless and fixed line internet use.

In light of the important role information and communication technologies play for political and governance processes (e-democracy) in engaging citizens, supporting democratic decision-making processes and strengthening representative democracy, as evidenced in the so-called Arab spring, a narrow focus on competition and regulatory issues seems inappropriate. This wider societal question has not been considered here. Whether there is a role for policy to go beyond addressing competition problems and potential consumer harm is a fundamental normative question, with the potential to override the conclusions reached here on efficiency grounds.